# Summary

A far forward proton spectrometer, Roman Pots (RPs) and off beam momentum detectors, are an integral part of an EIC detector, and thus are envisioned as a subsystem from day-one. Both will provide a critical contribution to the study of inclusive diffractive and exclusive production processes in coherent e+p, e+D and e+He3 collisions, and are essential to provide a veto of incoherent background to measurements of exclusive meson production in e+A collisions. AC-coupled LGADs (AC-LGADs) are proposed as sensor technology as they combine fine spatial resolution and precise timing. They can be pixelated as conventional pixel trackers, and timing performance can be maintained compatible with the 30 ps of LGADs developed for ATLAS and CMS.

**Accomplishments to date and Technological readiness**

Performance studies of transverse momentum smearing from beam angular divergence and crab cavity rotation of the beam bunch defined the detector specifications, and allowed to formulate a 'Strawman' detector layout: 2 stations of 2 layers of about 26x13 $cm^2$ area each, for a total of 1,311 $cm^2$ of silicon sensors. Significant progress has been made in the past couple of years on AC-LGAD design, fabrication, testing and optimisation. It was demonstrated that this technology is viable for applications at EIC, and specifically for RPs, as it builds upon the work for the LGADs at the HL-LHC. It was demonstrated that the sensors can be designed and fabricated at BNL and can meet the detector specifications set by the performance studies. Specifically, inactive edges of the sensors and readout ASICs can be reduced to less than 100 μm on the detector sides close to the beam, a time resolution of ~30 ps is achievable (34 ps was demonstrated in prototypes), and a segmentation of 500 μm is feasible. Such segmentation was found to be a good balance between physics performance and the cost for ASIC development. It was demonstrated in a dedicated assembly that the ALTIROC ASIC (CMOS TSMC 130 nm) developed for the ATLAS timing detector is compatible with AC-LGAD signals. The ALTIROC pitch can be from the current 1.3 mm to 500 μm with reasonable effort by the experts who designed the chip and are also members of the consortium. In parallel we keep investigating alternative low-power front-end technologies together with commercial vendors. An LGAD-based consortium was formed with 13 US and international institutes to coherently tackle technical challenges that are common to all applications of LGAD technology in various EIC subsystems.

**Work remaining for a TDR and Timeline**

Within 2 years, AC-LGADs can be confirmed as the baseline technology and optimised for RPs: time resolution can be improved to reach 30 ps or less; electrode and resistive layer designs can be further studied to optimise the signal sharing and spatial resolution; most critically, large-area sensors demonstrators must be fabricated. Within 2 years, the readout architecture can be developed and its viability demonstrated via simulations as well as laboratory tests based on existing prototypes for the HL-LHC, while in a 5 year time scale a more detailed design of the ASICs and the readout chain, including prototyping, can be achieved.

**Cost estimate**

The direct cost (excluding labor, R&D and pre-production) is estimated to be $1.2M: $260k for sensors, $280k for ASICs, $160k for on/off-detector electronics, $120k for mechanics/assembly, $70k for the cooling system, and a 1.33 factor was included as a projection of a possible underestimation of costs, based on the experience from the ATLAS timing detector in cost estimation in the LOI and in the TDR.